With reference to the brightness of *Capella*, we have the following considerations:—If the Sun were removed to the distance of *Capella*, it would appear 32 magnitudes fainter than at its present distance. Taking the Sun's magnitude as $-25{\cdot}5$, and *Capella's* as $+0{\cdot}2$, we find

Capella's brightness=480 times the Sun's brightness.

If the components are equal and have the same intrinsic brightness of surface as the Sun, it would appear that each component must have a diameter about 15 times that of the Sun. In this case eclipses could only be avoided if the angle between the normal to the orbit and the line of sight is not greater than that value which satisfies the equation $\frac{15\times 8\times 10^5 \sin i}{52\times 10^6}=\cos i$, or $i=77°$.

These considerations are enough to show that we are nearly within reach of interesting *facts* relating to the evolution of stars. If telescopic observations show that *Capella* is a double star, we shall be in a position to deal with a known case of a star with a spectrum similar to that of the sun, though its mass and brightness may be very different. The complete investigation of the spectrum of the *Procyon* component is also likely to be of great interest in the same connexion.

I have great pleasure in taking this opportunity of saying that I owe much to the skill and care of my assistant, A. W. Goatcher. He has secured more than half of the photographs from which I have made the measurements contained in this note; and I am indebted to him in numberless ways for his unremitting patience and devotion.

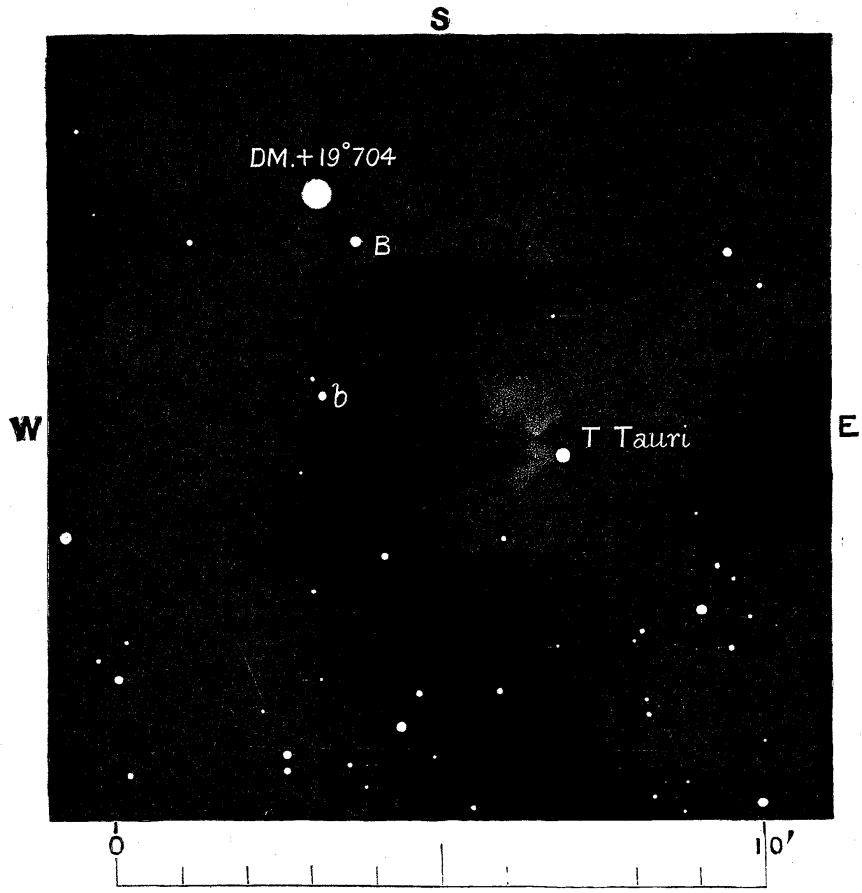
Note.—The best chance of detecting doubleness in *Capella* by visual observations through a large telescope will first occur about April 13, or say between April 3 and April 23. The approximate equality in brightness of the components shows that a dark glass may be used at the eye-end.

Photographic Observations of Hind's Variable Nebula in Taurus, made with the Crossley Reflector of the Lick Observatory. By James E. Keeler, D.Sc.

The region of *T Tauri* and Hind's variable nebula has frequently been scrutinised by observers with visual telescopes, but I have been unable to find any record of photographic observations. In making out an observing list for the Crossley Reflector, this region was therefore noted as specially requiring attention.

A complete history of previous observations of this region, together with original observations by himself and Mr. Burnham, has been given by Professor Barnard.* It will therefore be unnecessary for me to review the work of other investigators.

The first photograph with the Crossley Reflector was made on 1899 December 6, with an exposure of $3^h\ 53^m$. It showed a slight darkening of the film near *T Tauri*, which might have been an accidental stain. Accordingly, another photograph, with four hours' exposure, was made on December 27, and it proved to be in exact agreement with the first. Both photographs are good, and the star discs are almost perfectly round, but, for several reasons, they do not show as faint stars, by perhaps several magnitudes, as plates made with equal exposure-times during the fine nights of the previous summer.



Region of *T Tauri* and Hind's Variable Nebula.

From both negatives positives were made on glass with an enlargement of five diameters, and from one of these the accompanying diagram was copied, partly by tracing and partly by measurement. It represents a field 12′ square. The diameters

* *Monthly Notices, R.A.S.*, vol. lv. p. 442.

of the photographic star discs (on the enlargement) are quite approximately reproduced, the largest stars being a little too large, and the smallest a little too small, though the latter are still more conspicuous than they are on the enlargement itself.

Hind's nebula, as shown on the photographs, is faint and very irregular. Three patches, of which the middle one is the brightest, and which are not sharply bounded on any side, are connected by still fainter nebulosity. They do not seem to be connected with *T Tauri*, though it is quite likely that a connection might be traced on a stronger photograph. From the sketches made by Professor Barnard and other observers, it appears that the brightest patch, or the two patches nearly in line with D.M. $+19^\circ$ 704 are the parts of the nebula which have been observed visually.

The photograph shows no nebulosity whatever at the place of Struve's nebula.

At my request Mr. Aitken and Mr. Perrine examined this region with the 36-inch refractor on January 20 (a fine night). Hind's nebula was seen with difficulty, at the very limit of visibility, as were the faintest stars of the diagram. The magnitude of the latter may therefore lie between 16 and 17. The magnitude of the brighter star (*b*) at the place of Struve's nebula was estimated as 13; that of the smaller star as $15\frac{1}{2}$–16. The latter star was not seen by Professor Barnard, who says particularly that there was no star near *b*. The star is perhaps variable, or the conditions may have been more favourable on the night of Messrs. Aitken and Perrine's examination. Tempel's star near *b* does not agree in position with the star shown by the photograph.

On the night of January 20 both observers estimated that *T Tauri* was about half a magnitude fainter than the star *B* of the diagram. The photographic disc of *T Tauri* is, however, somewhat the larger. The photographic and visual magnitudes of these stars therefore do not agree, unless indeed there was a perceptible variation of the brightness of *T Tauri* between December 27, when the last photograph was taken, and January 20, when the visual observations were made.

Professor Barnard concludes from his investigation that Hind's nebula and Struve's nebula present incontestable cases of nebular variability, and it is likely that all astronomers agree with him. Indeed, it is inconceivable that the nebula near *T Tauri*, if no brighter than it is at present, could have been discovered with a small telescope. With respect to some of the details of the various observations of these nebulæ, which relate to objects at the very limit of vision, there is, I think, room for considerable doubt. So skilful an observer as Tempel has, as I have shown in an article which will be printed in another place,* drawn stars and nebulæ where none exist, while

* *The Astrophysical Journal* for January.

stars and nebulæ that certainly do exist escaped his notice. The fallibility of the observer must not be lost sight of.

Lick Observatory, University of California:
1900 *January.*

On a Simple Method of Comparing the Bonn Durchmusterung with Photographic Plates. By H. H. Turner, M.A., F.R.S., Savilian Professor.

1. The *Bonn Durchmusterung* gives R.A.s and Declinations for 1855·0. Measures of stars on a photographic plate give rectilinear coordinates (x, y) which are connected with standard coordinates (ξ, η) by linear relations

$$\xi = x + ax + by + c$$
$$\eta = y + dx + ey + f,$$

and (ξ, η) are connected with R.A. and Decl. for some other epoch (say 1900·0) by the relations

$$\xi = \tan(\alpha - A)\cos q \sec(q - D) \qquad \eta = \tan(q - D),$$

where $\tan q = \tan\delta \sec(\alpha - A)$,

and (α, δ) are the R.A. and Decl. of the star,

(A, D) „ „ „ „ plate centre.

A circuitous method of comparing the B.D. with the plate is thus to perform the following operations :—

(1) Bring up the B.D. places to 1900·0.

(2) Convert into standard coordinates.

(3) Multiply by the plate constants a, b, c, &c., to get coordinates comparable with measures on the plate.

The present paper indicates a method of dispensing with operations (1) and (3), and generally performing the comparison very quickly.

2. The places of the *Durchmusterung* are given to $0^s{\cdot}1$ in R.A. and $0'{\cdot}1$ in Declination. In terms of a *réseau* interval of 5′ (a unit now in common use for photographic measures) $0^s{\cdot}1$ on the equator represents 0·005, while $0'{\cdot}1$ represents 0·02. It will probably be sufficient accuracy in both coordinates if we calculate to 0·01 of a *réseau* interval, or in circular measure ·000015.

For the plates of the Astrographic Catalogue

x and y range from −·02 to +·02 in circular measure,

x^2 and y^2 „ „ 0 to ·0004,

x^3 and y^3 „ „ −·000008 to + 000008.